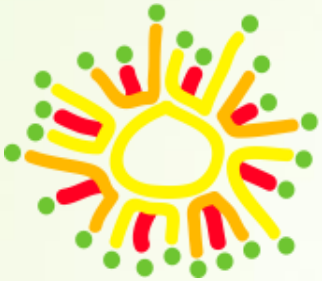
Getting the "Rubber on the Road"

From Discovery to Commercialization

IGERT NanoTechnology Seminar

John Fabel
Jattra Ventures, llc

- **SunEthanol Case Study**
- **Perspectives on Technology innovation and commercialization**
- **YOU as the tech transfer case study**



SunEthanol

Tech Transfer Case Study

John Fabel

Director of Intellectual Property and New Technology

NECEC
July 16, 2008

Energy Market is Changing

QuickTime™ and a
decompressor
are needed to see this picture.

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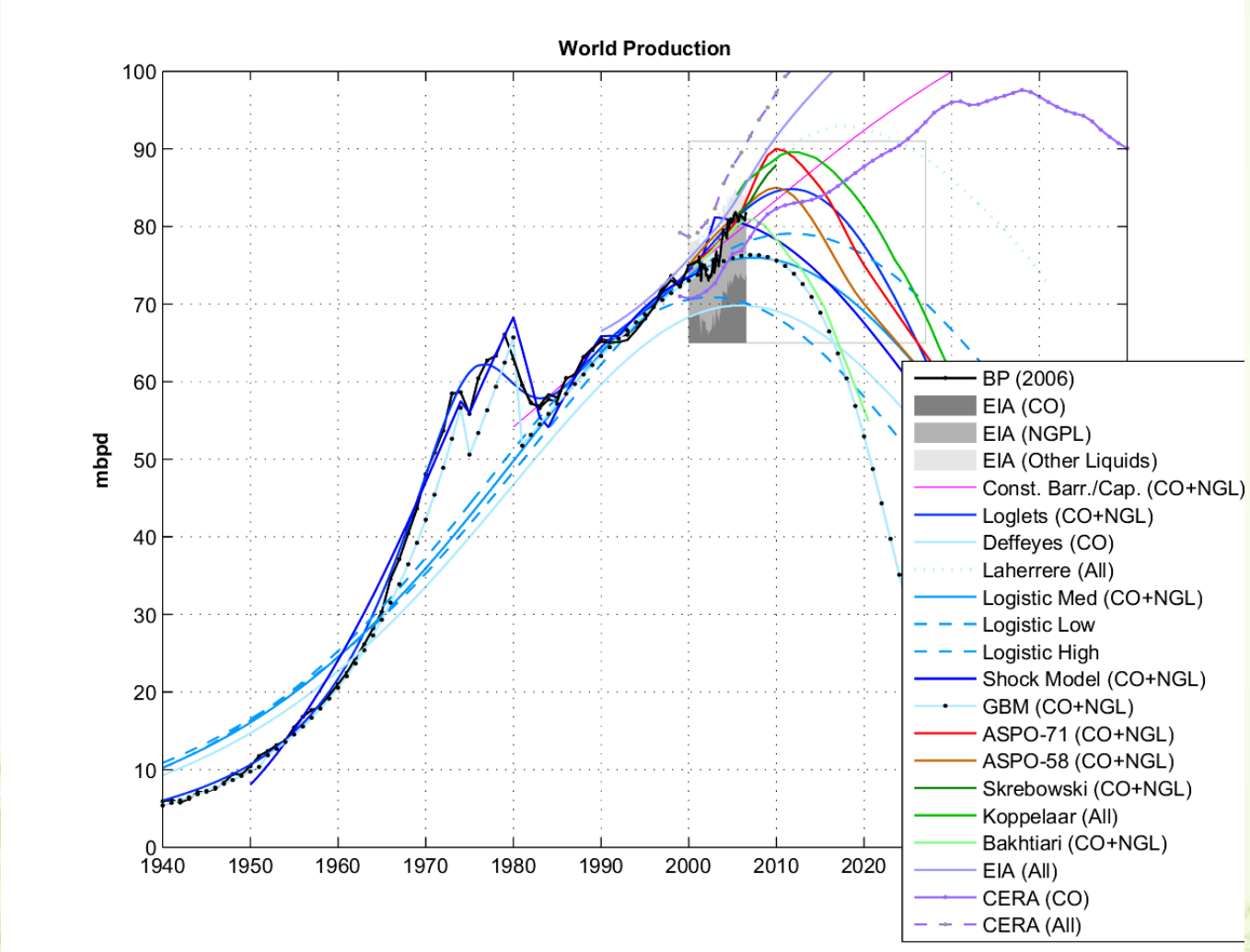
World Oil Production *(Crude oil + NGL) and various forecasts (1940-2050).*



Source: ASPO

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Energy Market is Changing

Emerging Multi-fuel Future:

– **Biomass energy** will play key role in multi-fuel future

– **Ethanol** will be key component of Biomass energy

What Is Driving Change:

–*Peaking oil supply >>>> Sustained high oil prices*

–*Declining EROEI for non-conventional fossil fuels*

–*Global Climate Change >> Need to Reduce CO2 emissions*

–*Energy security/trade balance*

Carbon Reduction Potential:

•Advanced biofuels most promising solution for reducing Greenhouse Gas emissi

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Biofuels are part of the solution:

- Development of *Cellulosic* Biofuels one of the most effective pathways to petroleum replacement and GHG reduction;
- *" … the highest potential for reduction in petroleum and fossil energy (and therefore greenhouse gases - GHG's) lies in biofuels…"*
- Important to utilize *sustainable* biomass sources

Source: World Energy Council (2007) Transportation Technologies and Policy Scenarios to 2050

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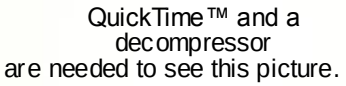

Source: Michael Wang, ANL

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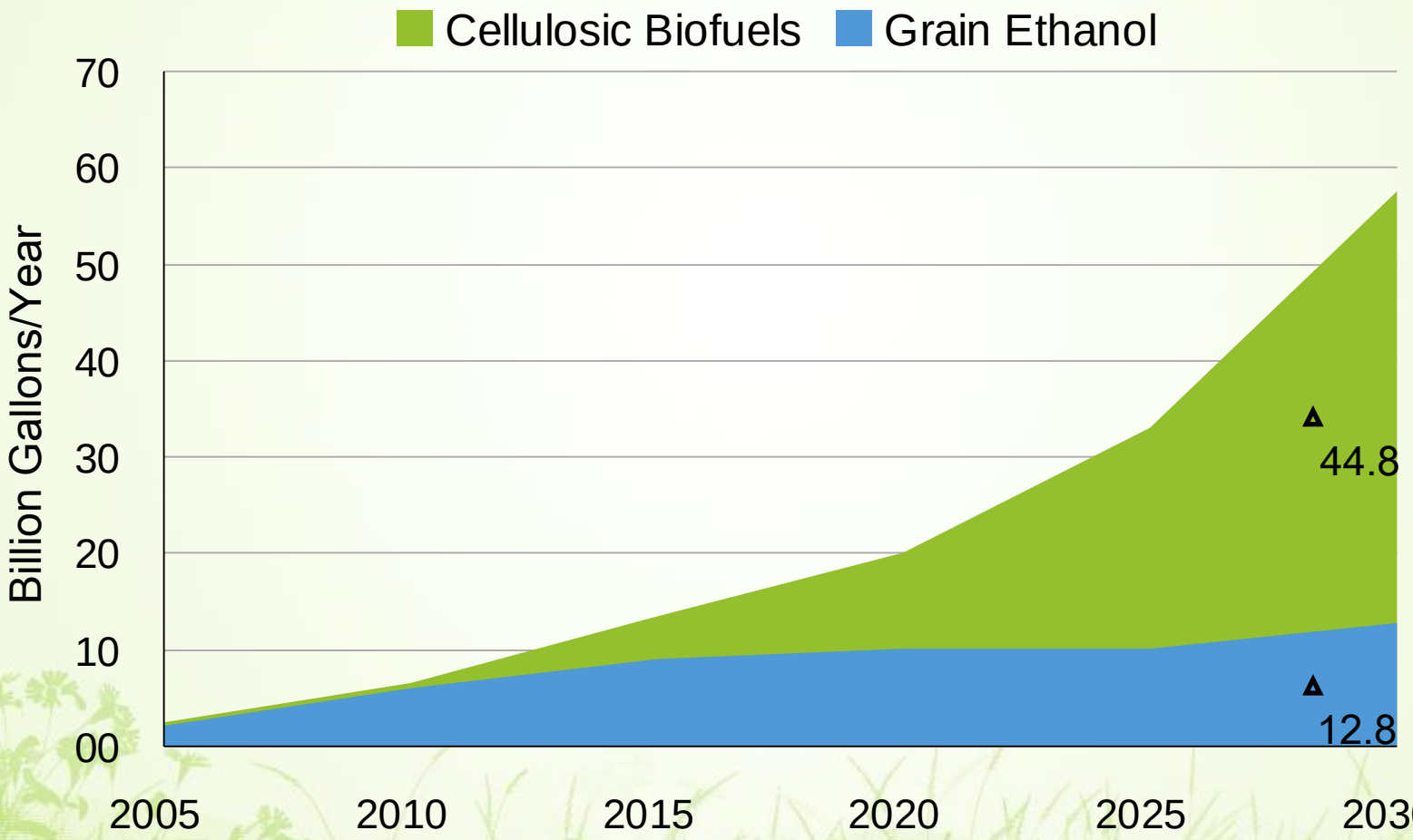
Energy Bill and DOE:
60B Gallons of Biofuels by 2030

Biofuels Growth Scenario to Supply 30% of 2004 U.S. Gasoline Demand by 2030



Source: James D. McMillan, Ph.D.
National Renewable Energy Laboratory

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Problem:

- **Biomass-to-Biofuels technologies** have not been sufficiently cost-effective to drive market

- **Enormous global opportunity** if versatile, cost-effective technology can be developed

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- Bio-fuels innovation company -- technology provider.
- Novel "**Q-Microbe™**" **technology-platform** provides fundamental breakthrough advantages compared to conventional competing technologies.
- **Addresses cost hurdles to opening the biofuels market.**
- Utilizes wide-range of global non-food biomass sources.
- Based upon novel microbe **("Q")** discovered by Umass Amherst microbiologist Dr. Susan Leschine.
- Licensed core patent application from Umass.
- Rapidly developed venture & successfully scaling technology.

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Breakthrough Technology

- Derived from unique, naturally-occurring microbial catalyst, *C. phytofermentans* ***("Q")*** **-** very unusual.
- Discovered near the Quabbin Reservoir -- *Mass native!*
- Important unique properties compared to other technologies:
  - **Both directly breaks-down AND ferments complex biomass:** *combines, simplifies and minimizes costliest/difficult aspects of other processes; other advantages.*
  - **Converts more of the biomass** -- higher net yields and conversion.
  - **Unusually versatile:** can utilize wide range of feedstocks such as waste-paper, wood, sustainable energy crops, and so on.
- Unique properties enabling SunEthanol to develop and commercialize biofuels technology platform with **breakthrough advantages.**

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A Few Highlights

- Founded November 2006, Amherst, MA
- Rapidly grown company and proven-out the technology
- Raised over $3.5M capital investment from leading VC's
- Closing $20M equity round to complete commercialization
- Created 22 jobs, will grow to 40+ following close of current financing round, moving to larger facilities
- Recruited high-profile CEO *(Dr. William Frey, formerly Director of DuPont's Biofuels Division)* and VP of R&D *(Dr. Sarad Parekh, formerly Bioprocess leader at Dow Agro-science and Merck)*
- Established key strategic commercialization partnerships
- Received several significant grants, including bringing collaborative research $$ into UMass
- Supported University post-docs and technicians
- Generated an extensive IP portfolio

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Founded upon Collaboration

- Licensed original IP from University of Massachusetts at Amherst
- Worlwide rights to utilize Q-microbe in related production processes
- Ongoing collaborative relationship with the University; very fruitful
- Utilizing industrial, academic and governmental collaborations to bring technology to market

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Building the Bridge

Technology commercialization combines the *skills and promise* of a discovery or technology, with the *active entrepreneurial support* a discovery or technology needs to move from an idea in the lab to a successful product and ve

Sagnitobel Bridge, SWI

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Building Commercialization Skills

- How to build the skills for translating technical skills and discovery into commercial application?

- **Crossing a conceptual divide:**
- Academia: Strong technology research skills
- Commercialization: similar skillset,
  - Different conceptual framework
  - Different goals and drivers

Intellectual Property

- ***Essential*** to understand intellectual property (**IP**) issues
- Important to commercialization, fundraising, licensing, “Freedom to Operate”
- Disclosure prior to publication!
- Prior Art
- Lab notebooks
- *Umass/SunEthanol experience*

Invention vs. Innovation

- Invention:
  - A unique/novel discovery or development
- Innovation:
  - The implementation of an idea or invention in such a way that it becomes culturally adopted.
- Commercialization:
  - Market-based innovation
- Entrepreneurship:
  - The pursuit of opportunity through the systematic implementation of an idea; “culture-changing activity”

Technology = Innovation?

- Technology *Innovation* occurs when a technology or technique is successfully configured and delivered to a problem or need.
- A *technology* itself is not necessarily an innovation.
- Building it does not mean they will come.

  Example: The Segway

Technology is the easy part

Technology Strengths

+

Entrepreneurial Skills

+

Identified Opportunity

(+ coffee…)

Companies are Commercializtion Vehicles

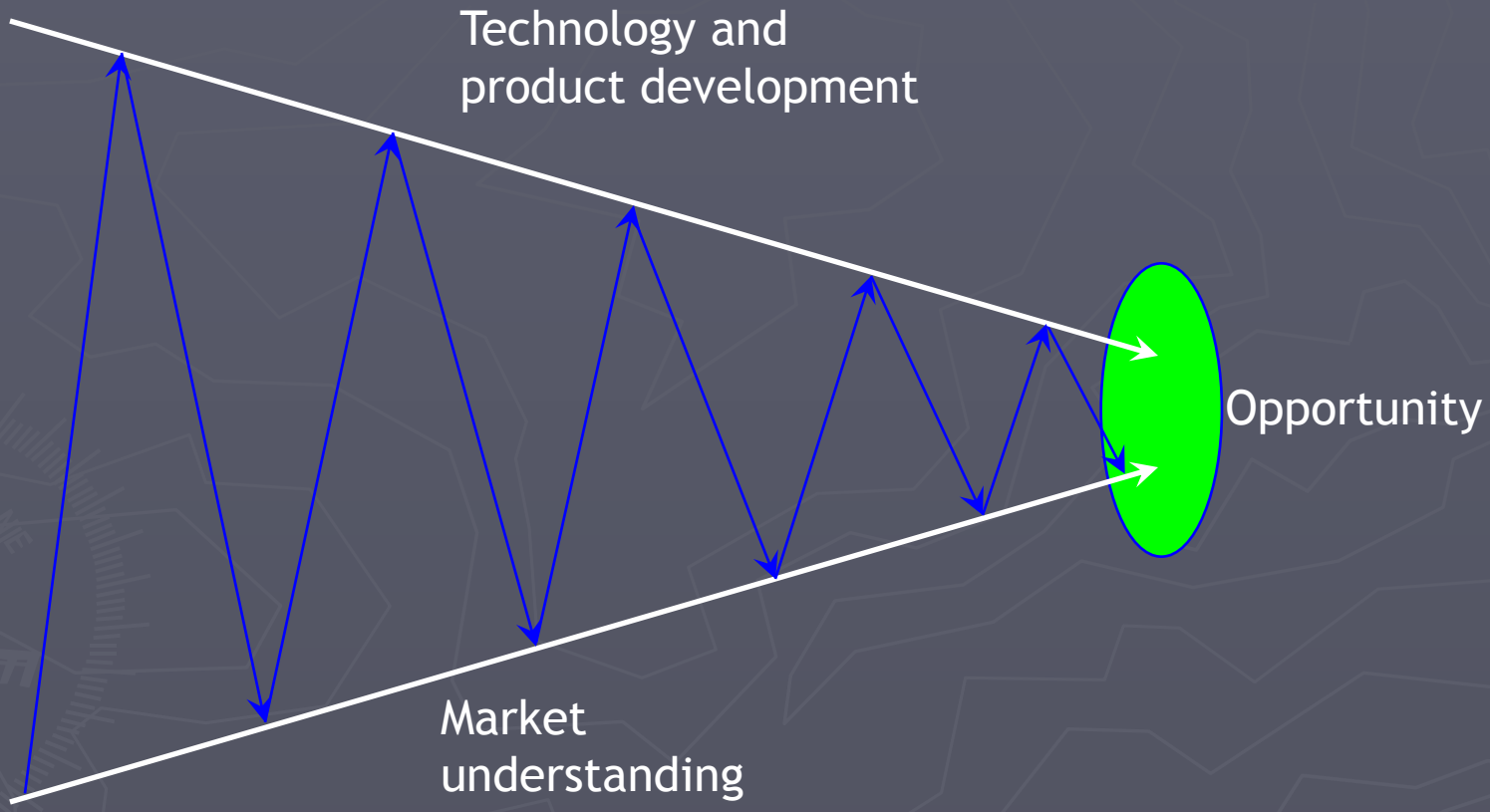
- Companies are commercialization vehicles
  - (as universities are research vehicles)
- Bring entrepreneurial skills together with technical skills
- Market/opportunity driven
- Enable access to capital
- Enable value to be created and captured

Markets & Opportunities Drive

- Commercialization is typically market driven, not technology driven.
- New technology can point toward market opportunity;
- Market need can point toward technology innovation opportunities

- Opportunity can be:
  - Technology Driven
  - Problem Driven
  - Change Driven

Technology Commercialization



Technology Assessment Hotlist

- What problem or need does it - or might it - solve?
- Where's the PAIN?!
- Has it been done before?
- Is there a market (and is large enough)?
- Is there a channel to market?
- Is there potential for intellectual property?
- Can the resources be marshalled?
- How badly do I want to do this?

From "**Technology**" to "***Product***"

- A **Technology** ≠ a **Product**

  1) It has to work
  2) People must want it
  3) It must be competitive with other ways of satisfying similar market need in terms of cost, etc.
  4) You need to be able to deliver it

“3 Faces of Product Design”

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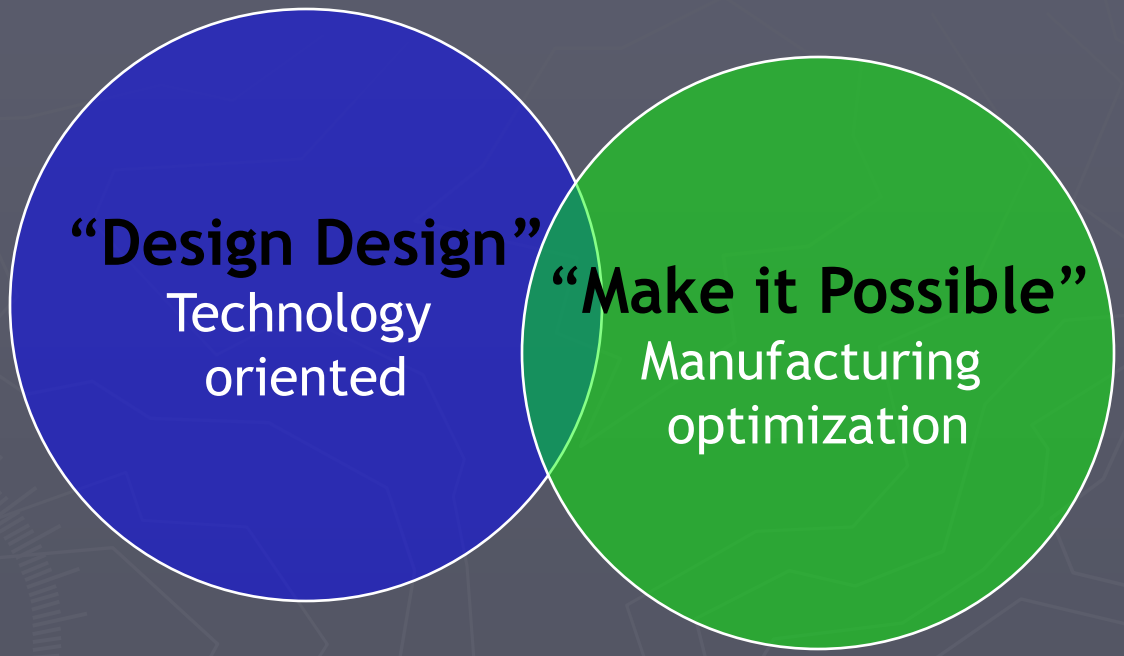
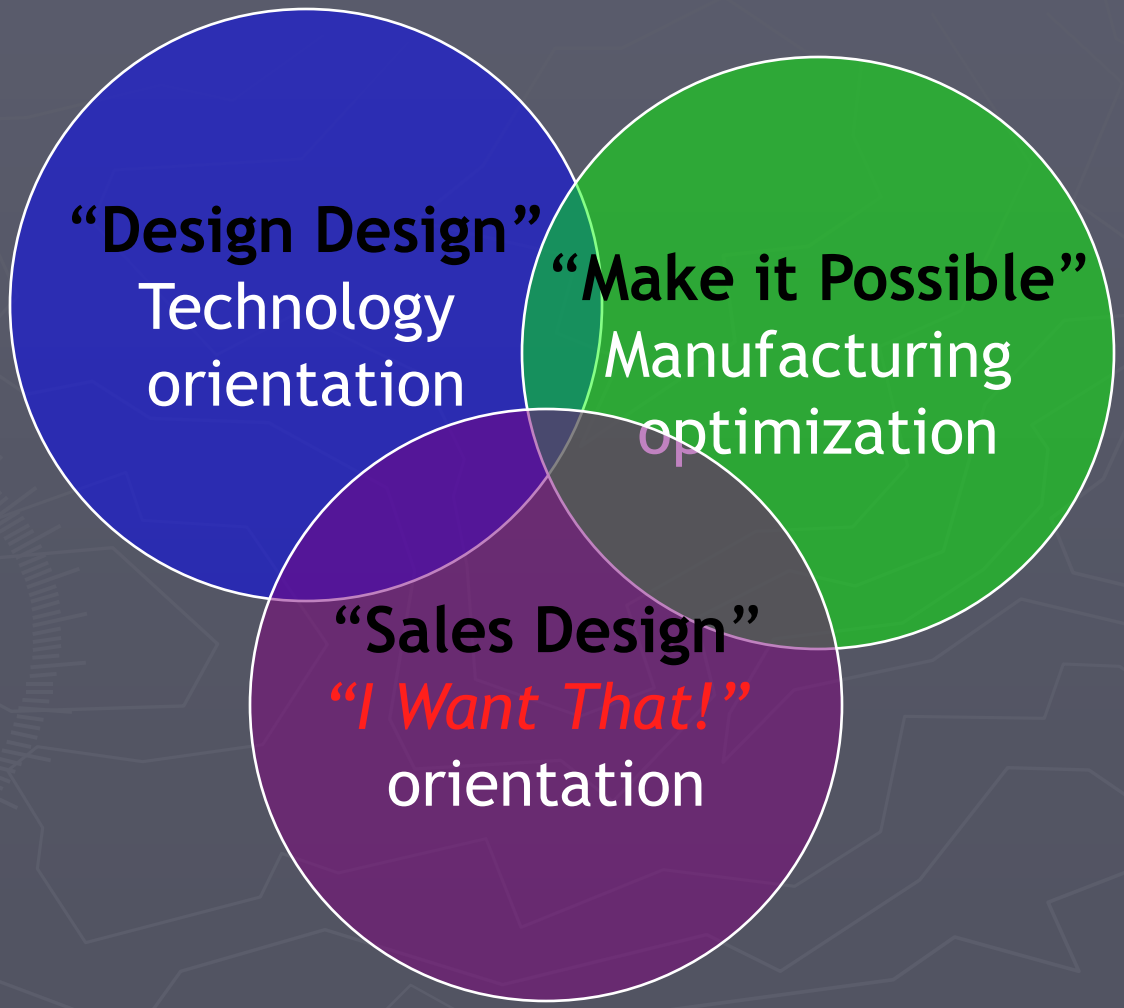


“3 Faces of Product Design”



Technology Transfer !

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Building the Bridge

Too often we see a disconnect between the *promise* of a discovery or technology, and the *active support* a discovery or technology needs to move from an idea in the lab to a successful product and venture.

Sagnitobel Bridge, SWI

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Technology Transfer

- Link academic research and applied need & opportunity
- Education and Pedagogy
- “Open Innovation” orientation
- Students as innovators
- Innovation and Entrepeneurship skills; e.g. IGERTs
- Collaborative research
- Grant Funding

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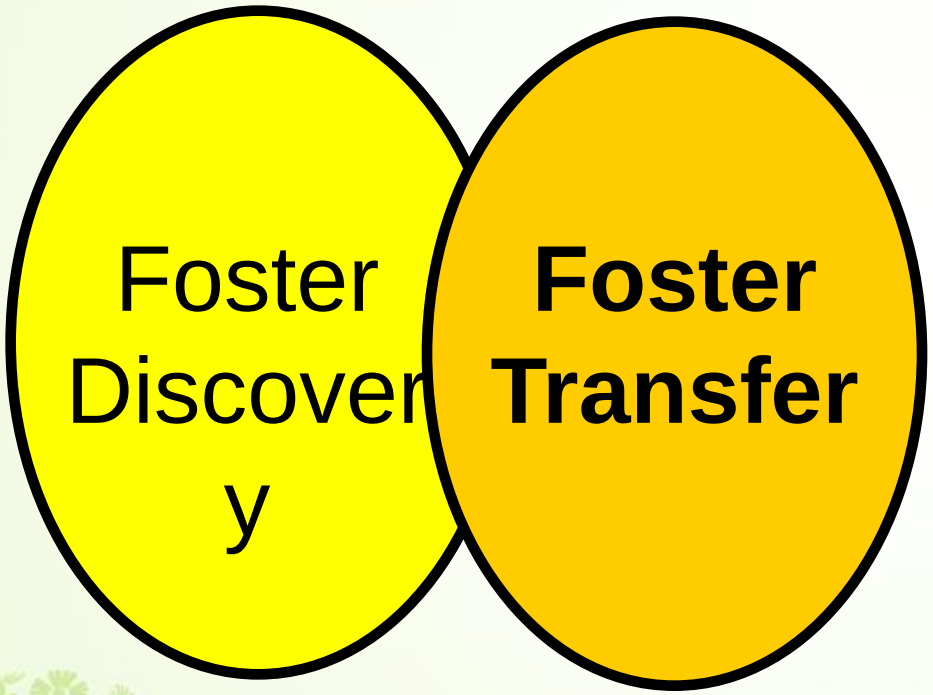
Technology Transfer



- Protect discovery
- Support IP protection
- Licensing:
  - encouraging of start-ups
  - Match expectations with private sector needs
- Support Faculty/Staff
- Student initiative

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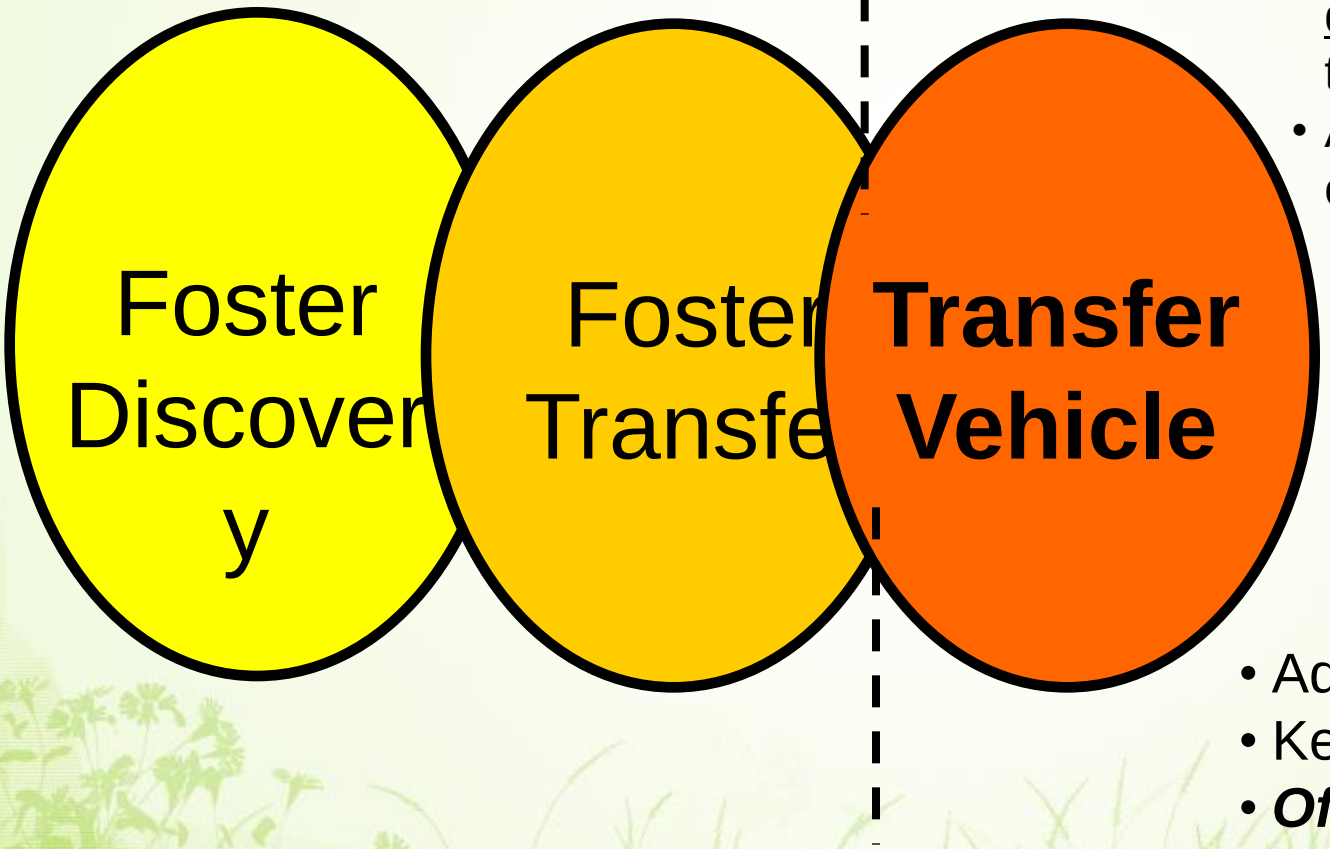
Technology Transfer



- ESSENTIAL
- "Vehicle" to translate discovery into viable technology
- Attract essential capital & commercialization talent

The Bridge

- Adds entrepreneurial skill
- Key value add
- ***Often the missing piece***

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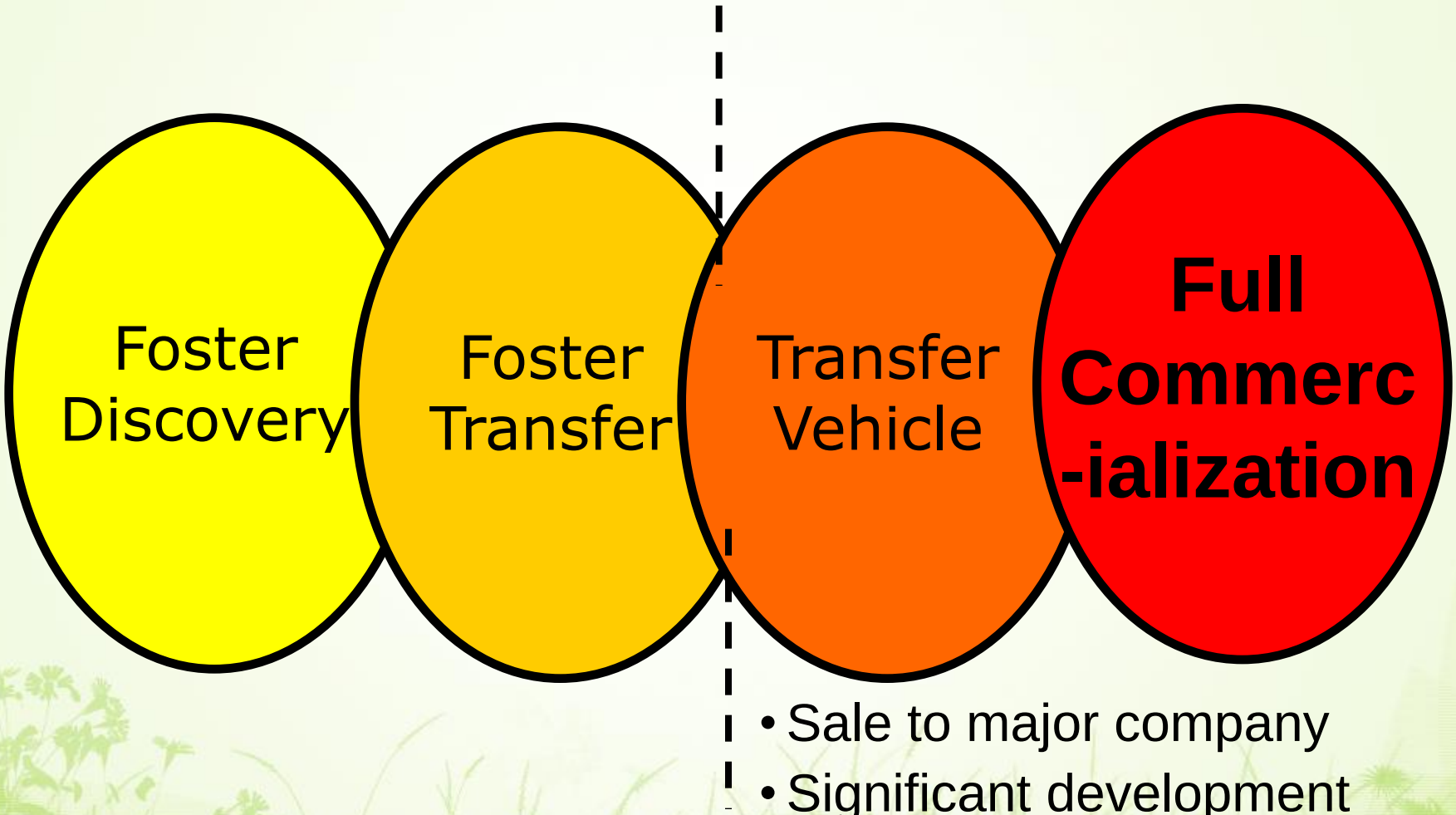
Technology Transfer



- Sale to major company
- Significant development event

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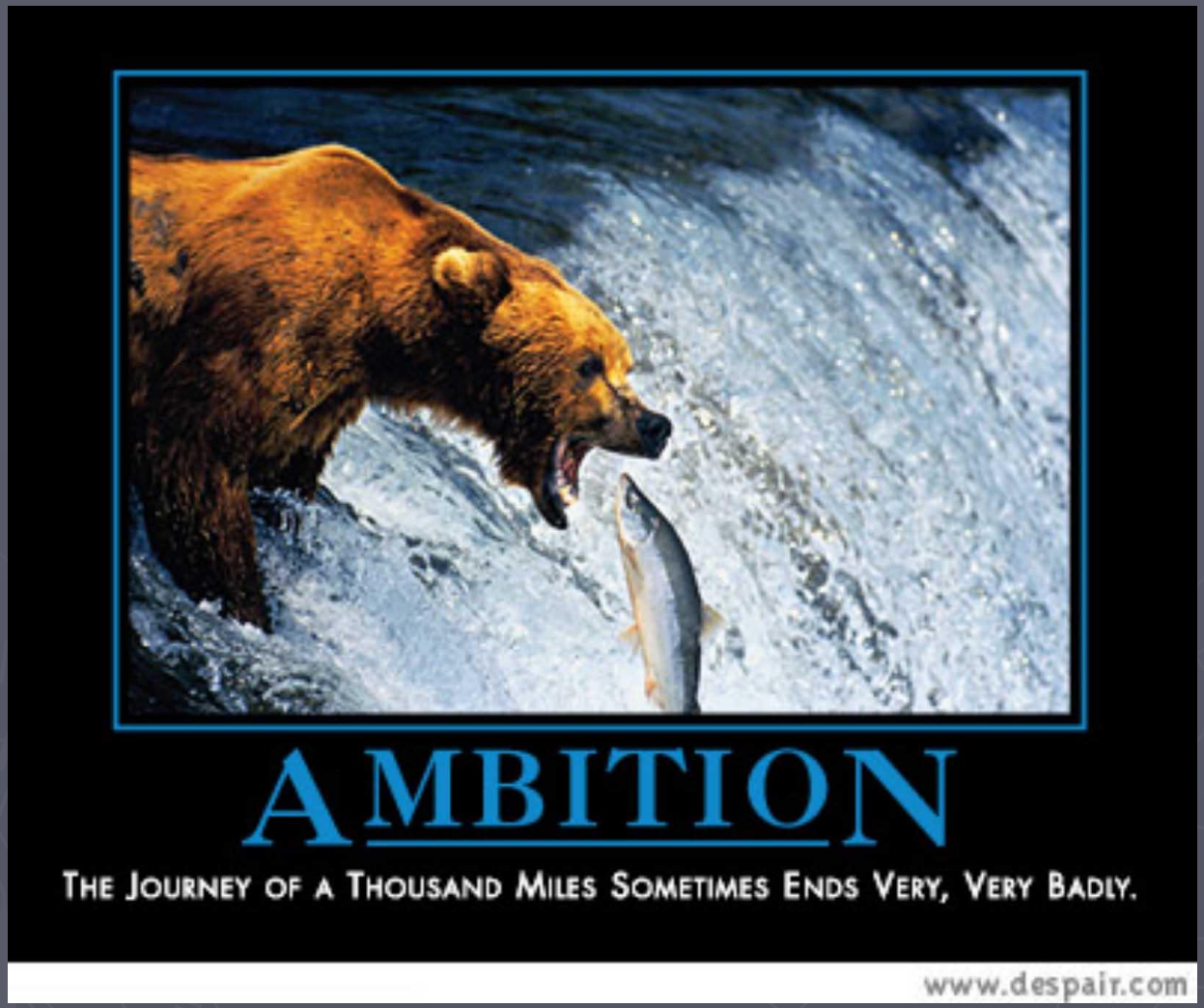

It might not work, despite your best efforts

- But then again, it just might